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Our research continues to study two primary areas. First is the area of visual attention where we have shown that there are both transient and sustained components. In contrast to the sustained component, we find that the transient component is much more powerful, is short lasting, is relatively independent of volition and finally, is also independent of the stimulus that elicits it. Thus, it is a genuine attentional effect not tied directly to the sensory stimulus but is probably operative relatively early in visual cortical processing, particularly in relation to the sustained component. We have also shown that the latency of this transient component is reduced by the prior removal of a stimulus fixation mark. Such a finding provides strong support for the view that express saccadic eye movements (seen under similar conditions) are mediated by rapid shifts of attention. (Continued on reverse side)

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Ken Nakayama, Ph.D.
AFOSR-83-0320

19. Abstract -- continued

Second, we have been studying issues related to partial visibility. In particular, we examine how the visual system deals with occlusion. Our results indicate that the occlusive relations of surfaces have widespread effects in vision, influencing color, motion, transparency and depth.

Ken Nakayama, Ph.D.
AFOSR-83-0320

FINAL TECHNICAL REPORT (September 1, 1985 - August 31, 1988)

Research Objectives:

Our goal has been to consolidate the phenomenological observations using objective techniques and to write up our results for publications.

Status of Research:

We have made detailed quantitative studies which have confirmed many of our preliminary observations. In particular, we have:

-- measured the depth of monocular points in stereograms,

-- quantified the amount of rivalry of monocular points as a function of the eye of origin and its relation to occlusion constraints,

-- found new phenomenon related to motion correspondence, showing that even motion correspondence is highly influenced by occlusive relations,

-- studied the relation between real and subjective contours and have found that the interactions are asymmetric, a finding consistent with physiological signs of subjective contours in area V2.

Manuscripts:

Over the past year, the following manuscripts have been completed, submitted or are in press.

1. Nakayama, K. The iconic bottleneck and the tenuous link between early visual processing and perception. In, **Vision: Coding and efficiency**, C. Blakemore (Ed.), Cambridge University Press (in press).

2. Nakayama, K., S. Shimojo and G.H. Silverman. Stereoscopic depth: Its relation to image segmentation, grouping and the recognition of occluded objects. Perception (in press).

3. Shimojo, S., G.H. Silverman and K. Nakayama. An occlusion-related mechanism of depth perception based on motion and interocular sequence. Nature **333**:265-268, 1988.

4. Shimojo, S., G.H. Silverman, and K. Nakayama. Occlusion and the solution to the aperture problem for motion. Vision Research (in press).

5. Nakayama, K. and M. Mackeben. Sustain and transient components of focal visual attention. (Submitted to Vision Research)

6. Paradiso, M.A., S. Shimojo and K. Nakayama. Asymmetric interactions between real and subjective contours and their relationship to the organization of visual cortex. (Submitted to Vision Research)

Participating Professionals:

Ken Nakayama, Ph.D.
Shinsuke Shimojo, Ph.D.
Manfred Mackeben, Ph.D.
Gerald Silverman, M.S.C.S.
Michael A. Paradiso, Ph.D.

Oral Presentations:

1. "The Iconic Bottleneck", Festschrift for Horace Barlow, Cambridge, England, September 5, 1987. (K. Nakayama)

2. "Intelligent Systems and Intelligent Vision", Annual Meeting of the Japanese Psychological Association, University of Tokyo, Tokyo, Japan, October 12, 1987. (S. Shimojo)

3. "A Transient Component of Visual Attention", Institute of Medical Psychology, University of Munich, F.R.G., October 14, 1987. (M. Mackeben)

4. "The Iconic Bottleneck", NASA Ames Research Center, Mountain View, CA, January 20, 1988. (K. Nakayama)

5. "Occlusion Related Visual Constraints", Department of Psychology, Texas Technical Institute, Lubbock, TX, January 25, 1988. (S. Shimojo)

6. "Occlusion Related Visual Constraints", Department of Ophthalmology, Texas Technical Institute, Lubbock, TX, January 26, 1988. (S. Shimojo)

7. "How does the Visual System Deal with the Problem of Occlusion?", Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, Cambridge, MA, February 3, 1988. (K. Nakayama)

8. "How does the Visual System Deal with the Problem of Occlusion?", Department of Psychology, Harvard University, Cambridge, MA, February 4, 1988. (K. Nakayama)

9. "How does the Visual System Deal with the Problem of Occlusion?", Department of Psychology, Brown University, Providence, RI, February 5, 1988. (K. Nakayama)

10. "Occlusion Related Visual Constraints", School of Optometry, University of California, Berkeley, CA, February 5, 1988. (S. Shimojo)

11. "Occlusion Related Visual Constraints", Department of Psychology, University of San Diego, La Jolla, CA, March 14, 1988. (S. Shimojo)

12. "How does the Visual System Deal with the Problem of Occlusion?", European Brain and Behavior Society Workshop on Visual Processing of Form and Motion, Tuebingen, F.R.G., March 19, 1988. (K. Nakayama)

13. "How does the Visual System Deal with the Problem of Occlusion?", National Eye Institute, National Institutes of Health, Bethesda, MD, March 23, 1988. (K. Nakayama)

14. "How does the Visual System Deal with the Problem of Occlusion?", Howard Hughes Medical Institute, Miami, FL, March 30, 1988. (K. Nakayama)

15. "Depth, Rivalry and Subjective Contours from Unpaired Monocular *Points*", The Association for Research in Vision and Ophthalmology, Inc. (ARVO), Sarasota, FL, May 2, 1988. (K. Nakayama)

16. "Asymmetric Interactions between Real and Subjective Contours Demonstrated with the Tile Aftereffect", The Association for Research in Vision and Ophthalmology, Inc. (ARVO), Sarasota, FL, May 2, 1988. (M.A. Paradiso)

17. "Fixation Release Facilitates Rapid Attentional Shifts", The Association for Research in Vision and Ophthalmology, Inc. (ARVO), Sarasota, FL, May 3, 1988. (M. Mackeben)

18. "Occlusion and the Solution to the Aperture Problem for Motion", The Association for Research in Vision and Ophthalmology, Inc. (ARVO), Sarasota, FL, May 4, 1988. (S. Shimojo)

19. "Occlusion Related Visual Constraints", Department of Psychology, Stanford University, Stanford, CA, July 6, 1988. (S. Shimojo)

20. "How does the Visual System Deal with the Problem of Occlusion?", Department of Psychology, Rockefeller University, New York, NY, August 8, 1988. (K. Nakayama)